Efficient Calibration of Seawater Intrusion Models

Juan J. Hidalgo[1], *Jesús Carrera*[2] and *Agustín Medina*[3]

[1]Department of Geotechnical Engineering and Geosciences, School of Civil Engineering, Technical University of Catalonia, Barcelona, Spain

[2]Institute of Earth Sciences "Jaume Almera", Spanish Research Council (CSIC), Barcelona, Spain

[3]Department of Applied Mathematics III, School of Civil Engineering, Technical University of Catalonia, Barcelona, Spain

ABSTRACT

The calibration of groundwater models is a complex and time-consuming task. In seawater intrusion models the computational burden of the calibration process is increased by the high computational cost of solving the coupled non-linear equations that describe density-dependent flow and transport. The automatic calibration of seawater intrusion models with analytical evaluation of the sensitivities (variations of the state variables with respect to the parameters) is a feasible alternative to the more common parameter perturbation approach. The efficiency of this method lies in the fact that the matrices required for solving the inverse and the forward problems are equal if the Newton-Raphson method is used for solving the latter one. The extra cost of the Newton-Raphson method is compensated with a more efficient computation of the sensitivities. The computational performance of the proposed method is tested by calibrating a synthetic seawater intrusion problem and comparing the results with the ones obtained with the parameter perturbation technique. The comparison is made for variable problem dimensions such as number of nodes, matrix bandwidth and number of estimated parameters.

Contact Information: Juan J. Hidalgo, Department of Geotechnical Engineering and Geo-Sciences, Technical University of Catalonia (UPC), C/ Jordi Girona 1-3, Building D-2, 08034 Barcelona, Spain, Phone: +34 934017244; Fax: +34 934017251, Email: juan.hidalgo@upc.edu